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ABSTRACT

This paper discusses critical questioning (i.e., Socratic questioning) as a requirement for critical thinking and examines how critical questioning techniques can be incorporated into a technology-based course. A taxonomy of Socratic questioning is presented that includes the following categories of questions: questions of clarification; questions that probe assumptions; questions that probe reasons and evidence; questions about viewpoints or perspectives; questions that probe implications and consequences; and questions about the question. The following five general educational functionalities of the latest development of Internet technology, called Infosphere, are summarized: tele-access, virtual publishing, tele-presence, tele-mentoring, and tele-sharing. Course requirements of a research strategies course at St. Cloud State University (Minnesota) that utilized some of the Infosphere functionalities (tele-accessing, tele-sharing, tele-mentoring) are outlined. (MES)

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Developing Critical Thinking Skills in a Technology-Related Class

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Abstract

Students are expected to be able to think critically. As more courses become technology-based and increased emphasis is placed on technology applications, educators need to strive to develop students' critical thinking skills. This presentation will address critical questioning as a requirement for critical thinking and will describe techniques and resources for including critical thinking in technology-based courses. Participants will explore Socratic questioning and see how this technique can be incorporated into a classroom that is predominantly technology-based.

Developing Critical Thinking Skills

Just what is a critical thinker? According to Richard Paul, a critical thinker is someone who is able to think well and fairmindedly about his or her own beliefs and viewpoints as well as those which are diametrically opposed. The critical thinker does not just think about these beliefs and viewpoints, but explores and appreciates their adequacy, cohesion, and reasonableness. Attitudes and passions are included. To become a critical thinker is not to be the same person you are now, but only with better abilities; it is to become a different person (p. iii)

Critical thinking is expected (at least by state departments of instruction, university curriculum committees, and educators) of students. This skill, however, must be developed, and it requires a great deal of effort on the part of teachers to help students learn to think critically. In order for students to develop these skills, teachers must learn to incorporate critical questioning into their classes; the responsibility for developing the critical thinking skills shifts from the student to the teacher as questioning becomes the guiding force. It is the teachers, not textbooks, that have the power to shape students' ability to think (Chalupa and Sormunen).

Critical thinking and critical questioning can be incorporated into nearly every course. However, the technology-based courses introduce a challenge as well as an opportunity. This presentation will discuss critical questioning (referred to as Socratic questioning) techniques and how they can be incorporated into a technology-based course, given the electronic resources available.

Socratic Questioning

Socratic questioning is at the heart of critical thinking; it is more than eliciting a one-word response or an agreement/disagreement from students. In a short sentence, Socratic questioning requires students to

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make assumptions, distinguish between relevant and irrelevant points, explains points, can be highly elaborated or undeveloped; and may be mono- or multi-logical. Socratic instruction can take many forms. Paul (p. 270) states that Socratic questioning:

- raises basic issues
- probes beneath the surface of things
- pursues problematic areas of thought
- helps students discover the structure of their own thought
- helps students develop sensitivity to clarity, accuracy, and relevance
- helps students arrive at judgment through their own reasoning
- helps students note claims, evidence, conclusions, questions-at-issue, assumption, implications, consequences, concepts, interpretations, points of view Q the element of thought.

A Taxonomy of Socratic Questions

To make the Socratic questioning method readily usable by teachers, identifiable categories of questions have been established (Paul, pp. 276-77):

- questions of clarification
- questions that probe assumptions
- questions that probe reasons and evidence
- questions about viewpoints or perspectives
- questions that probe implications and consequences
- questions about the question

Questions of clarification

Questions of clarification are basically asking for verification, additional information, or clarification of one point or main idea. The student would be expected to provide the information, expound on an opinion, rephrase the content, or explain why he/she made that particular statement. Clarification may also be requested from others in the discussion group.

Questions than probe assumptions

Many questions can center around the concept of assumptions. The student may be asked for clarification, verification, explanation, or reliability of the assumption. Students may also be asked to identify another assumption which might apply to the particular case.

Questions that probe reasons and evidence

This category of probing questions asks for additional examples, evidence which has been discovered, reasons for making statements, adequacy for the reasons, process which lead student to this belief, or anything which would change the student's mind on this issue.

Questions about viewpoints or perspectives

The student might be asked whether there are alternatives to this viewpoint or perspective, how might other groups or people respond, what argument a person might use who disagrees with this viewpoint, or a comparison of similarities and differences between viewpoints.

Questions that probe implications and consequences

The student might be asked to describe and discuss the implication of what is being done or said, the effect which would result, the alternatives which might be feasible, or the cause-and-effect of an action.

Questions about the question

The student might be asked to identify the question, the main point, or the issue at hand. In addition, the student might be asked to break the question into single concepts rather than multiple concepts or determine whether some type of evaluation needs to take place. The student or discussion group may also be asked to identify why this question is important.

Segue to Technology-Based Classroom

The first part of the presentation identified how critical thinking on the part of students depends a great deal on the critical questioning skills of the teacher. We have seen clear examples of using critical questioning in a class which is largely discussion. Once a teacher masters critical questioning skills, there is the next step which must be mastered Q incorporating these skills into a classroom where technology is a large part of the course.

Including Critical Thinking in Technology-Based Courses

Incorporating critical thinking into a technology-based course places additional responsibility on both the students and the teacher. Global technology and information access provide the substance for research and discussions, and the instructor and students provide the final step Q assimilation and incorporation of information.

The Technology-Related Classroom

The dynamics of the educational process rest on two essential components: communication and resources. Information technologies can so enhance classroom communications and resources that, when properly applied, they can transform conventional pedagogical paradigms and create new powerful context for learning and teaching. Connected classrooms potentially offer open-ended, dynamic, discovery-oriented learning experiences. The more advanced the classroom use of telecommunication is, the greater the potential to change the learning environment, the teacher's role in the classroom, and the flow of information to students overall classroom dynamics; each can evolve to form more natural and much richer learning processes.

Technology-related classrooms are those classrooms where learning is structured around primary concepts, whole to part, with emphasis on the big picture. Students are viewed as thinkers with emerging theories about the world. Lessons are not arbitrary, but build on issues relevant to the student. In a technology classroom, teachers behave in an interactive manner, mediating the environment for students. "Guide on the side not a sage on the stage." Pursuit of student questions and opinions is highly valued and activities rely heavily on primary sources of data and manipulative materials. Assessment of student learning is interwoven with teaching and occurs through teacher observations of students at work and through student presentations and authentic projects. Frequently the student work is collaborative. In a nutshell, computer-based technology instruction is about conceptual understanding demonstrated through application, typically on projects using primary source materials. In other words, emerging technology is incorporated with critical thinking in technology-based classrooms. Important features of these classrooms are: access, operability, organization of resources, engagement, ease to use, and functionality of information.

Developing critical thinking skills in technology-related classrooms is quite a challenge for teachers. Since information is the principal ingredient of much learning, instructional design and teaching in an information-rich environment will be carried out differently than in traditional environments. The learning process will be characterized by a new theory of applied learning, with a new role for the teacher and new instructional design.

The role of the teacher is going to be modified in a very important way, with leading and guiding taking over from giving information. The chaotic nature of the Net will require teachers in particular to assist students in questioning the world around them and judge the validity of information accessed, thus sharpening critical thinking and imagination.

Online teaching becomes very much a content matter, if not an outright curriculum matter. Selecting specific content to be read by students in a course of study loses its function when a wide variety of appropriate material is accessible on the Net. Course design focuses then on the objectives to be achieved and not on the means of achieving them, a strong shift in our instructional design paradigm (Duchastel & Breuleux, 1996). The specification of learning objectives at a higher level of generality, one which permits different students to achieve these objectives differently (through different projects, through learning different content, etc.), is more in tune with emerging information Net context than is the traditional model.

In this presentation we will concentrate on only one technology: Internet as a source of this information-rich environment. How it helps to enhance critical thinking depends on how we use the latest development of Internet technology, called Infosphere (Brenfeld, 1996). This portion of the presentation will be based on five general educational functionalities of the Infosphere (Berenfeld, 1996):

- tele-access
- virtual publishing
- tele-presence
- tele-mentoring
- tele-sharing

Each is discussed in further detail in the following paragraphs. Please keep in mind that the Internet will be the primary source of information.

Tele-access

Students use online resources in learning including libraries, databases and other classrooms. When students use an online search, they get into real world databases, and they construct their own knowledge. They can access unlimited information from any place.

Virtual Publishing

Students can publish their projects by using virtual publishing on the World Wide Web. They can publish multimedia projects as well as hypertext documents.

Tele-presence

Tele-presence enables the students to experience events on remote sites. With the use of video technologies, students can actually be present at remote sites. Classes can journey on real expeditions and participate in real experiments, without students actually leaving the classroom.

Tele-mentoring

Mentoring through telecommunication is the most important and rich learning option for students. When students get responses to their questions from scientists or scholars (who serve as online mentors), they get expert views beyond the textbooks' "knowledge".

Tele-sharing

Tele-sharing often begins with simple e-mail chats between "keypals". It advances to "one-to-many" and "many-to-many" communications, and then blossoms into sharing of resources, ideas, experiences, data and findings. Students can share the communication and knowledge in small groups as well as large groups.

These educational functionalities of Infosphere can enhance the critical thinking skills and critical questioning. But the success of these functionalities depends on high level connectivity and mastery of

some of the metaphors and their functionalities. Teachers need to develop the telecommunication-based curriculum modules in these courses. In this presentation we will sample such a course developed and taught at St. Cloud State University, where some of Infosphere functionalities (tele-accesing , tele-sharing, tele-mentoring) were used.

The St. Cloud State University Example: IM 204: Research Strategies (MGM)

This course was designed to examine basic university-level research while utilizing multicultural, gender, and minority content and issues in library learning resources. A large number of these students were incoming first-year students, while others were more advanced. All were introduced to technology-based research gathering opportunities.

Course Requirements

Students in this course were given specific course requirements, as noted below:

a. Students were placed into groups and were required to read one book from the reading list. Each group was required to initiate the discussion in the class and write a book report.

b. Students were required to write five individual abstracts outside class.

c. To master the research strategies, students were required to use telnet and Internet, fetch, gopher, and Usergroups for their research and assignments.

d. The course was divided into different modules. Each module was a complete unit of instruction. Students were required to select one module and write a final research paper by using multimedia information research technologies.

Student groups were required to read one book from the reading list. Each group was required to initiate the discussion among its members by posting members' critical evaluations of books on the group's user group. After group tele-discussion, each group wrote a book report based on guidelines provided by the instructor. Six groups read three books and presented the book reports in large group in class. These user groups were open user groups, where any student from another group could read the critical evaluation. Students used tele-sharing to write the book report.

For the research paper, every student selected one module and used Internet, online searching, CD-ROM, and video to conduct their research. Some students interviewed the author of the book and defended his/her thesis. Students not only gathered data from books and journals, but they also used authentic knowledge to support their theories. Papers were presented on a variety of different issues: human rights, sexual harassment, race and discrimination, immigration, and poverty related to Native American, Mexican and Hispanic and other ethnic groups.

Conclusion

Critical thinking is based on critical questioning, just as critical questioning is strongly linked to searching out the whys and wherefores, the what ifs and what others. Not only can teachers use critical thinking and critical questioning in traditional classroom formats, but they can also incorporate activities in the technology-related classroom which will teach students critical thinking skills. By being well prepared with the discipline content and knowledgeable in the use of critical questioning, today's teacher

can prepare students to access information on a world-wide basis. By accessing data and information, students gain knowledge; by using the knowledge they have gained, students achieve power in the information world.

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